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SOME RESULTS OF SANITARY LEGISLATION IN ENGLAND SINCE 1875.

BY GARY N. CALKINS, S.B.

The *Revue Scientifique* for April contains a review of an article by M. H. Monod on the results of sanitary legislation in England. This article is entitled *Les résultats des mesures sanitaires en Angleterre depuis 1875*, and advocates the extension of sanitary measures in France, where the diminution in population has lately caused much concern.

In 1875 a general law was passed in England for the protection of the public health. This was known as the Public Health Act, and from this time the death rate in England has decreased for all diseases which owe their origin and growth to defective drainage and impure water supplies. Typhoid fever is such a disease, and the diminution of 57 per cent in the death rate from this malady is undoubtedly the greatest triumph for sanitary reformers.

The cost of sanitary improvements up to 1890 was about \$583,500,000, or a mean annual expense of about \$42,000 000, and the immediate effect was a marked decrease in the number of deaths, as the statistics will indicate.

During the 10 years from 1866 to 1875 the average annual mortality was 22.19 per 1000 inhabitants living, as the following figures show:—

Year.	Rate.	Year.	Rate.
1866	23.4	1871	22.6
1867	21.7	1872	21.3
1868	21.8	1873	21.0
1869	22.3	1874	22.2
1870	22.9	1875	22.7

From 1838, the first year that registration was taken in a careful manner, to 1865 the average annual rate was about 22.35 per 1000 living. It is sufficiently accurate to state that, for the period 1838 to 1875, the average death rate remained about the same.

But for the 10 years of the period 1880 to 1889 the average falls to 19.08; and it is interesting to note that a curve representing the rate since 1875 does not show the great fluctuations which are characteristic of the period before that time. This is probably due to the few epidemics in the last fifteen years, that of 1878 being the most noticeable when there was a large infant mortality from diarrhoea and whooping cough. The great rise in 1849 and again in 1854 was caused largely by an epidemic of cholera. In 1863, 1864, 1865, and 1866 typhoid fever kept the death rate up to an average of 24.31 per 1000. Since 1878 the rate is almost uniformly descending, as the following figures show:—

Year.	Rate.	Year.	Rate.
1879	20.7	1885	19.0
1880	20.5	1886	19.3
1881	18.9	1887	18.8
1882	19.6	1888	17.8
1883	19.5	1889	17.9
1884	19.5

It seems justifiable to assign as the cause of this diminution in the death rate the operation of the Public Health Act and the execution of duties such as drainage, inspection of water supplies, vaccination, and others, which are becoming better and better understood.

Mr. Farr, in his *Vital Statistics*, estimates the value of human life in England to be about \$770 a head. "The minimum value of the United Kingdom, men, women, and children, is £159 (\$770.36) a head; that is the value inherent in them as a productive money-earning race." (W. Farr, *Vital Statistics*, p. 61.)

The economic value to England of improvements which will check certain diseases, such as typhus, is obvious, for this complaint is especially virulent to man in the adult age, that is, in the age when he is producing to the best of his ability; and, from a strictly practical standpoint, we can calculate the value of the expense to England of the vast sums which she has given out for the protection of the public health.

If we suppose, which is allowable if other things remain the same, that the mortality for each year of the period 1880 to 1889 had been the same as the average annual death rate for the period 1866 to

1875, then, comparing this average with the true rate, we find the number of lives saved has been :—*

Year.	Lives Saved.	Year.	Lives Saved.
1880	43,457	1885	87,722
1881	85,743	1886	80,546
1882	68,412	1887	95,758
1883	72,013	1888	125,680
1884	72,996	1889	124,477

The total gives a gain of 856,804 lives saved, and this, according to Mr. Farr's estimate, represents a social capital of more than \$650,000,000. Thus in 10 years the country has more than regained the sum that was spent for sanitary improvements in the 15 years; and in this calculation nothing figures for maladies avoided ; nothing for that which cannot be expressed by figures,—spared grief, better health, and happier life.

Mr. Noel A. Humphreys, in an article published in the *Journal of the Statistical Society*, has proved that, if the death rate should continue as low as it was from 1876 to 1880, the duration of the average life of men would be prolonged two years; that of women more than three years as compared with the English life tables; and that 70 per cent of men and 65 per cent of the women concerned would be from 20 to 60 years of age, or, in other words, that the extra life would be added to the most productive age. (Longstaff: *Studies in Statistics*, p. 226.)

The diminution of mortality is not observed in all forms of disease, and the relative importance of sanitary measures for certain diseases is shown in the following table. The mortality from zymotic diseases from 1861 to 1870 was 42.54 per 10,000 living, and this was reduced to 24.52 in the period from 1880 to 1889, thus diminishing 18.02 per 10,000 inhabitants. This diminution was distributed in the following order :—

Measles	0.02	Diarrhoea, dysentery.....	2.56
Diphtheria	0.33	Scarlet fever	5.92
Whooping cough	0.78	Typhoid fever.....	6.36
Cholera	0.91		
Small pox.....	1.14	Total.....	18.02

* I have found mistakes in the *Revue d'hygiène* in the calculation of these figures, and have therefore re-computed them from the Report of the Registrar General for 1889.

Thus, while the number of deaths from typhoid and scarlet fevers has decreased notably, measles, diphtheria, and whooping cough have apparently almost completely escaped the influence of sanitary measures.

Consumption has equally diminished in England in these last years. The mortality from this cause was, in the years 1861 to 1870, 24.89 per 10,000 living. For the period 1880 to 1889 it fell to 17.36, a difference of 7.35 per 10,000.

Let us see in just what manner England has gained by these sanitary improvements; at what period or age life has been saved, and whether the average length of life has been affected. The reports of the Registrar General furnish the necessary data.

In studying the figures for the decade 1871 to 1880 it will be seen that the death rate is unequally distributed for the period of the earlier years, but rises for the later years; for men after 35, for women after 45. This is shown by an instructive table taken from Longstaff's *Studies in Statistics*, published on the opposite page. This shows the death rates for males from all causes per 1000 living at various groups of ages. The average death rate for fifty years is printed in heavy type, as are also the figures for the decade in which the maximum death rate at each age was reached. The last row of figures indicates the rise or fall per cent of the average death rate for the last decade above or below the average for fifty years.

From this table we see that for the early periods of life the death rate has decreased. In the last decennium for example, the maximum rate for males between the ages of 5 and 10 was 9.23 per 1000 in the period 1839-48. The average for the fifty years is 7.78, and the fall from this average in the decade 1879-88 was 28.5 per cent. For the age of 10 to 15 the death rate decreased from the maximum 5.11 in the period 1849-58 to 30.8, and the fall from the average 4.34 for 50 years was 29 per cent. For the ages of 15-20 the fall was 26.3 per cent from the average 6.04. But for the ages between 35 to 45 the maximum death rate was in the decade 1869-78 13.97, and in the last decade 12.51, and the diminution from the average 13.03 for the fifty years falls only 4 per cent; while for the age 45 to 55 the average rate of the last decade exceeds the average for the five decennia by 2.6 per cent, and for the age 65 to 75 it exceeds the average by 3.7 per cent; for the age 55 to 65, 3.3 per cent. But above the age of 85 years the death rate diminishes from the average by 1.1 per cent.

DEATHS PER 1000 LIVING MALES.*

Periods.	All Ages.	0-5	5-10	10-15	15-20	20-25	25-35	35-45	45-55	55-65	65-75	75-85	85-
1839-1848	23.05	71.76	9.23	5.06	7.09	9.45	9.80	12.65	17.83	31.43	66.89	147.5	313.1
1849-1858	23.27	72.68	8.86	5.11	6.87	9.10	9.86	12.80	18.38	31.35	65.88	146.8	306.2
23.47	73.92	8.07	4.50	6.28	8.55	9.75	13.22	18.90	32.62	66.40	146.3	313.4	
1859-1868	23.13	69.96	7.18	5.63	7.53	7.75	13.97	20.01	34.53	69.29	149.5	322.7	
1869-1878	20.48	60.13	5.56	3.08	4.45	5.88	7.96	12.51	19.40	33.84	70.24	147.7	309.5
1879-1888													
50 Years.	22.68	69.49	7.78	4.34	6.04	8.15	9.42	13.03	18.90	32.75	67.74	147.6	313.0
Fall or Rise Per Cent.	"	-9.7	-13.5	-28.5	-29.0	-26.3	-27.9	-15.5	-4.0	+2.6	+3.3	+3.7	+0.1
													-1.1

* Longstaff, *Studies in Statistics*, Page 269.

From this table we see that sanitary measures affect the death rate for persons between the ages of 1 and 25 years, and especially during the period of youth from 10 to 20 years. Economically this is a great gain, for the 28 per cent of those who might have died during this age have now tided over this period of non-production, when they were a burden on the state, into a producing age. Had they died at the age of 20 or thereabouts the country would have gained no recompense for the expense of maintaining them through the non-productive period.

Or, to put this another way.¹ In 1854 a new-born boy might hope to live 39.91 years. But his son, born in 1880, could hope for 41.35 years. Now, suppose both attain to the age of 40. In the first case 26.06 more years of life might be expected, but in the second case only 25.30. Or again, suppose 1,000,000 male children were born during the period 1838-54, then, at the age of fifty-five, 409,460 would survive; of 1,000,000 male children born during the period 1871-80, at the same age of fifty, 424,677 would survive. But, at the age of seventy-five, 148,076 would survive in the first case, while in the second there would be only 144,960. That is, the death rate during the most mature age is greater than formerly. This may be due to the fact that, with improved sanitary precautions, more feeble children live to maturity and die before attaining to old age; or, perhaps, because of the bustle of the nineteenth century, of the wear and tear upon the nervous system due to competition in densely packed cities and towns.

The effect of sanitary improvements is most noticeable upon infant mortality. If we take 858,878 as the mean annual number of births between 1871 and 1880, the difference between this and the number born in an average year of the period 1838-54 shows a gain of 1,800,047 years,² and this alone is a great defence of the sanitary work now going on. How this may tend to weaken the race is not for me to surmise, at all events it is too late to return to Spartan methods of maintaining the race perfect.

France, it is affirmed, is sadly in need of such sanitary improvements as have diminished the death rate in England during the last twenty years. At present her population is at a stand-still, but it should increase, and, unless it does, there is something wrong in the

¹ *Sanitary Progress.* Edinburgh Review. January, 1891.

² The above figures are taken from *Sanitary Progress*.

body politic, since all surrounding countries are growing rapidly in population. Whatever the cause may be for such a small number of births per year, whether moral, or physical, or political, they are all remote and obscure, but the death rate is something that can be viewed and compared, and its causes investigated. Dr. Brouardel,¹ in a recent address before the *Académie de Médecine*, called attention to the disproportionate death rate in France from small pox and typhoid fever. In Germany 110 persons are lost annually by small pox, while in France the number is no less than 14,000. Dr. Brouardel attributes this to the rigidity with which vaccination is enforced in Germany, and the laxity in France.

There are 23,000 deaths from typhoid fever per year in France, and this was shown to be largely due to water supply. Thus in Vienna, before pure water was introduced, the death rate was 200 per 100,000 inhabitants; after the introduction of good water it fell to 10.

In Angoulême pure water reduced the number of deaths from typhoid fever in the proportion of 18 to 0.063. In Amiens from 111 in 10,000 to 7. In Rennes from 43 in 10,000 to 2. Dr. Brouardel affirms that if vaccination and re-vaccination were obligatory in France, and that if towns were compelled to supply pure water, the saving of life would amount to from 25,000 to 30,000 annually, and this would make considerable difference in the population.

¹ *London Lancet*, January, 1890.